California Environmental Protection Agency

Air Resources Board

Vapor Recovery Test Procedure

Proposed TP-205.1

Determination of Efficiency of Phase I Vapor Recovery Systems of Novel Facilities

Adopted: April 12, 1996
Amended: [Date of Amendment]

Note: ~~Strikeout text is deleted text which was provided in 4/3/98 staff report.~~
Underlined text is new text which was provided in 4/3/98 staff report.
Sections of the text not shown remain unchanged**.**

3 BIASES AND INTERFERENCES

Before and after the performance of all other field data collection for this test procedure, the subject dispensing facility shall demonstrate compliance with the appropriate static pressure performance standard ~~as~~ if required by CP-205 Section 4.

4 SENSITIVITY, RANGE, AND PRECISION

The measurements of concentration and volumetric parameters required by this test procedure are well within the limits of sensitivity, range, and precision of the specified equipment.

5 EQUIPMENT

Equipment specifications are given below.

5.1 Hydrocarbon Analyzer

The range of any hydrocarbon analyzer shall be selected such that the maximum concentration measured is no more than 90 percent of the range and the average concentration is no less than 10 percent of the range.

Any sampling and analysis system using a non-dispersive infrared detector (NDIR) shall be designed so that 100% of the sample that is extracted for analysis can be returned, unaltered, to the sample manifold.

An analyzer with a NDIR with selected filters to block methane measurement shall be used when the efficiency is to be calculated for non-methane hydrocarbon and when the system under test is small such that extracting a sample for a FID analyzer will affect the system operating parameters. When using a NDIR instrument for total hydrocarbon measurements, a second channel must be present to measure the methane concentration or the instrument filters must be such that total hydrocarbon is measured.

Any sampling and analysis system using a flame ionization detector (FID) can not be designed so that 100% of the sample that is extracted for analysis can be returned, unaltered, to the sample manifold, because the operation of the FID significantly alters the portion of the sample which is analyzed.

An analyzer with a FID may be used for the test when a measurement is for total hydrocarbon and there is no requirement for returning sample, unaltered, to the sample manifold. ~~An important example is the total hydrocarbon measurement on the diluted sample from a test sleeve which has captured transfer emissions from the nozzle fillpipe interface. In this case, the transfer emissions are on their way to the atmosphere normally, so there is no need to return them to a sample manifold.~~

5.2 Carbon Monoxide Analyzer

Use a NDIR analyzer for measurement of exhaust CO concentrations. To the extent practical, the analyzer range shall be selected such that the maximum concentration measured is no more than 90 percent of the range and the average concentration is no less than 10 percent of the range.

5.3 Carbon Dioxide Analyzer

Use a NDIR analyzer for measurement of exhaust CO_2 concentrations. To the extent practical, the analyzer range shall be selected such that the maximum concentration measured is no more than 90 percent of the range and the average concentration is no less than 10 percent of the range.

5.4 Volume

Use a calibrated positive displacement gas volume meter or a turbine meter for measurement of volumetric flow rate.

Use rotary type positive displacement meter(s) with a back pressure limit (BPL) less than:

1.10 inches water column at a flowrate of 3,000 CFH down to
0.05 inches water column at a flowrate of 30 CFH for a meter with a rating over 1000 CFH and

0.70 inches water column at a flowrate of 800 CFH down to
0.04 inches water column at a flowrate of 16 CFH for a meter with a rating of or under 1000 CFH.

Meter(s) shall be equipped with taps accomodating the following equipment:

(1) taps on the inlet side for

(a) a thermocouple with a range of 0 to 150 ^{o}F and

(b) a pressure gauge with a range providing absolute pressure readings within 10 to 90% of the range (more than one gauge shall be used, if necessary) and

(2) taps on the inlet and outlet sides for a differential pressure gauge with a range of 0 to < 2x BPL (i.e. full scale shall be less than twice the back pressure limit) or any other range appropriate to allow detection of a pressure drop greater than the BPL.

5.5 Pressure

Use a pressure measuring device (transducer, inclined manometer or Magnahelic gauge) with a design range suitable for the pressure being measured. The tap for the pressure measurement will be located on the sample coupling attached to the inlet of the volume meter.

5.6 Temperature

Use a temperature measuring device (thermocouple or mercury in glass thermometer) with a design range suitable for the temperature being measured. The tap for the temperature measurement will be located on the sample coupling attached to the inlet of the volume meter.

5.7 Other Sampling Implements

The sample schematic (~~Figure 1~~ TP-201.2 Figure 12) requires, in flow order from the sample manifold:

(1) a vapor/liquid separator,
(2) a fine-particulate matter filter,
(3) a pressure tap,
(4) an adjustable bypass valve for vapor return to the sample manifold (not necessary for sleeve sampling), and
(5) a rotameter

The sample line shall be of inert material (teflon is preferred). The sample pump will be a stainless steel bellows type.

6 CALIBRATION PROCEDURE

A record of all calibrations shall be maintained.

6.1 Analyzers

Follow the manufacturer's instructions concerning warm-up time and adjustments. On each test day prior to testing, zero the analyzer with a zero gas and span with a known concentration of calibration gas at a level near the highest concentration expected. Perform an intermediate zero and span calibration approximately 2 hours after the initial calibration and at any time a calibration drift is evident. Check for zero and span calibration drift at the end of the test period. All calibration and adjustments shall be documented.

6.2 Volume Meters

Meters shall be calibrated on an annual basis.

6.3 Pressure Transducers

Calibrate pressure transducers prior to testing and immediately following the test period with a static pressure calibrator for a range such that measured pressures fall within 10% to 90% of the range.~~of -3 to +3 inches water or appropriate range of operation.~~

6.4 Temperature Transducers

Calibrate temperature transducers ~~every six months~~ at the beginning and end of each week of testing using ice water and using ambient air, the temperature of which is determined by a NIST traceable mercury-glass thermometer.

7 PRE-TEST PROTOCOL

7.1 Location of Test Site

Prototype systems will be located within 50 miles of Sacramento for testing. Other locations may be accepted at the discretion of the ARB Executive Officer.

7.2 Specification of Test, Challenge, and Failure Modes

The specification of test, challenge, and failure modes such as the number of liquid transfer episodes, volume and volumetric rate of liquid transfer, storage tank volumes, etc. shall be done according to the principles of CP-205 § 5 for the testing and evaluation of vapor recovery equipment.

7.3 System and Facility Preparation

System equipment and components shall be completely operational and any storage tanks involved in the test shall be filled to the appropriate volume a minimum of 24 hours prior to the scheduled test.

In addition, the system and facility shall be prepared to operate according to any specified test, challenge, and failure modes.

8 TEST PROCEDURE

The facility and system shall be prepared to operate according to any specified test, challenge, and failure modes.

In this section, the term "vent" and the specified procedures for testing vents shall also apply to any assist processor with which such procedures are compatible. Procedures are also specified for incinerator type assist processors. Any assist processor which is incompatible with the application of these procedures shall not be certified until the compatibility requirements of the certification procedures are met.

8.1 Test Locations

Figure 1 illustrates mass flux test locations.

8.1.1 Test Point 1 (Vapor Return Line)

The vapor return line sample and temperature and pressure measurements must be taken from the camlocked sample manifold which has been inserted at a fitting in the vapor return line. Unaltered sample shall be returned to the sample manifold.

Volume and volumetric flow rate may be directly measured at Test Point 1 only after an engineering evaluation has determined that ~~there will not be excessive pressure drop across~~ the volume meter meets the requirements of Section 5.4. Otherwise these parameters will be calculated from the volume of liquid transferred.

8.1.2 Test Point 2 (Vent and/or Assist Processor)

The vent and/or the assist processor sample and temperature and pressure measurements must be taken from a sample manifold attached to the inlet side of the volume meter which has been inserted at a break in the vent line or at the exhaust side of a assist processor. The operation of test equipment shall not interfere with the normal operation of any valve or vent. Unaltered sample shall be returned to the sample manifold.

Data for calculating vent and/or assist processor emissions shall be collected for a time following completion of the portion of the test involving specified facility operations. The determination of the appropriate duration for such data collection shall be made by the ARB Executive Officer based on an engineering evaluation of data collected during and after the specified facility operations.

8.1.3 Test Point 3 (Vapor Incinerator)

Specific procedures are provided below for testing incinerators due to the complexity of such testing. Other types of assist processors, e.g. adsorbers, are tested by the more conventional hydrocarbon sampling and analytical procedures specified in other sections.

8.1.3.1 Incinerator Performance Specifications

Incinerator emissions shall be determined using the procedures of EPA M-2B, as outlined in this procedure, including any additional requirements provided below.

Any incinerator shall be evaluated and tested to establish:

(1) a performance specification for ~~carbon monoxide (CO)~~ hydrocarbon (HC) emissions and

(2) performance specifications for other critical incinerator operating parameters per CP-201 § 3 which requires, in part:

The results of evaluation and testing of the system, documented in the certification test report, shall include:

(1) the identification of such critical system operating parameters,

(2) the performance specifications for such critical system operating parameters, and

(3) the specification of requirements for indicating gauges, detection devices, and alarms.

Challenge and failure mode testing shall be performed to establish system sensitivity to and performance specifications for the following variables:

(1) storage tank ullage at start of liquid transfer and

(2) volume and volumetric rate of liquid transfer

~~(3) number of nozzles in simultaneous use and~~

~~(4) individual nozzle dispensing rates.~~

Compliance with the incinerator performance specifications shall be determined per CP-201, as applicable.

8.1.3.2 Incinerator Sampling Parameters

A preliminary evaluation of incinerator operation shall be conducted to assess the rate of change of the magnitude of measured parameters. An appropriate time interval for data recording shall be determined. ~~A preliminary evaluation of incinerator operation shall be conducted to determine data collection intervals for time and parameter magnitude for each parameter.~~ Such intervals shall be chosen to provide calculated estimates of incinerator mass emissions factors which differ by no more than ± 10% from actual, based on engineering judgment.

Data for each parameter shall be collected on such intervals.

Collect and record incinerator data for all of the parameters required to make a determination per EPA M-2B, with additional requirements for auxiliary fuel to expand the applicability of EPA M-2B:

V_{in} = total inlet volume entering vapor incinerator (SCF)

$V_{facility}$ = inlet volume from the facility vapor space (SCF)

V_{fuel} = inlet volume of auxiliary fuel (SCF)

V_{out} = vapor incinerator outlet volume (SCF)

N = number of carbon atoms in each molecule of calibration gas

$[HC]_{facility}$ = hydrocarbon concentration of inlet volume from the facility vapor space (volume fraction)

$[HC]_{fuel}$ = hydrocarbon concentration of auxiliary fuel (volume fraction)

$[HC]_{out}$ = vapor incinerator outlet hydrocarbon concentration (ppm)

15 EXAMPLE FIGURES

Figure 1 is a schematic drawing showing some of the test location details for novel facilities.

Each figure provides an illustration of an implementation which conforms to the requirements of this test procedure; other implementations which so conform are acceptable, too. Any specifications or dimensions provided in the figures are for example only, unless such specifications or dimensions are provided as requirements in the text of this or some other required test procedure.

Note:
Further procedural details, figures, forms, and tables are provided in the other test procedures; such can be used after appropriate modifications for novel aspects of a tested system have been made, on a case-by-case basis, subsequent to an engineering evaluation.

Revised

FIGURE 1
Test Locations for Novel Facilities